

Thinking inside the grid: from multi-instrument satellite data to uniform space-time information

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Introduction

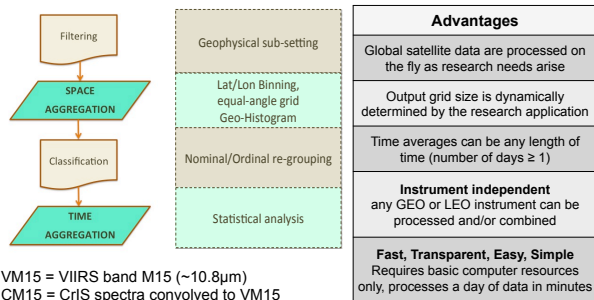
We are exploring methods for combining data from different space-based instruments into meaningful environmental and climate information. STG has been developed to allow the projection of radiance measurements (Level 1) or retrieved data (Level 2) from any instrument to a uniform space-time configuration.

Goal: to compare the measurements or derived products of multiple instrument measurements (with different spatial configurations) mapped to a uniform space-time domain. The STG approach is demonstrated in the comparison of the brightness temperature (BT) difference of two instruments, where sensitivity to co-location and heterogeneity issues are overcome.

Method: Results are calculated for the daytime orbits of two instruments on 1 May 2012 (viewing angles $\leq 39^\circ$) gridded to 0.5°/1.0°/2.0° grids

- **Imager:** Suomi-NPP Visible Infrared Imaging Radiometer Suite (VIIRS)
- **Sounder:** Suomi-NPP Cross-track Infrared Sounder (CrIS)
- CrIS radiance spectra convolved and converted to VIIRS BT band M15 (~10.8µm).
- CrIS spatial resolution = ~14km; VIIRS spatial resolution = ~1km

Space-Time Gridding (STG) Processing Framework



Calculate statistics from uniform scenes only

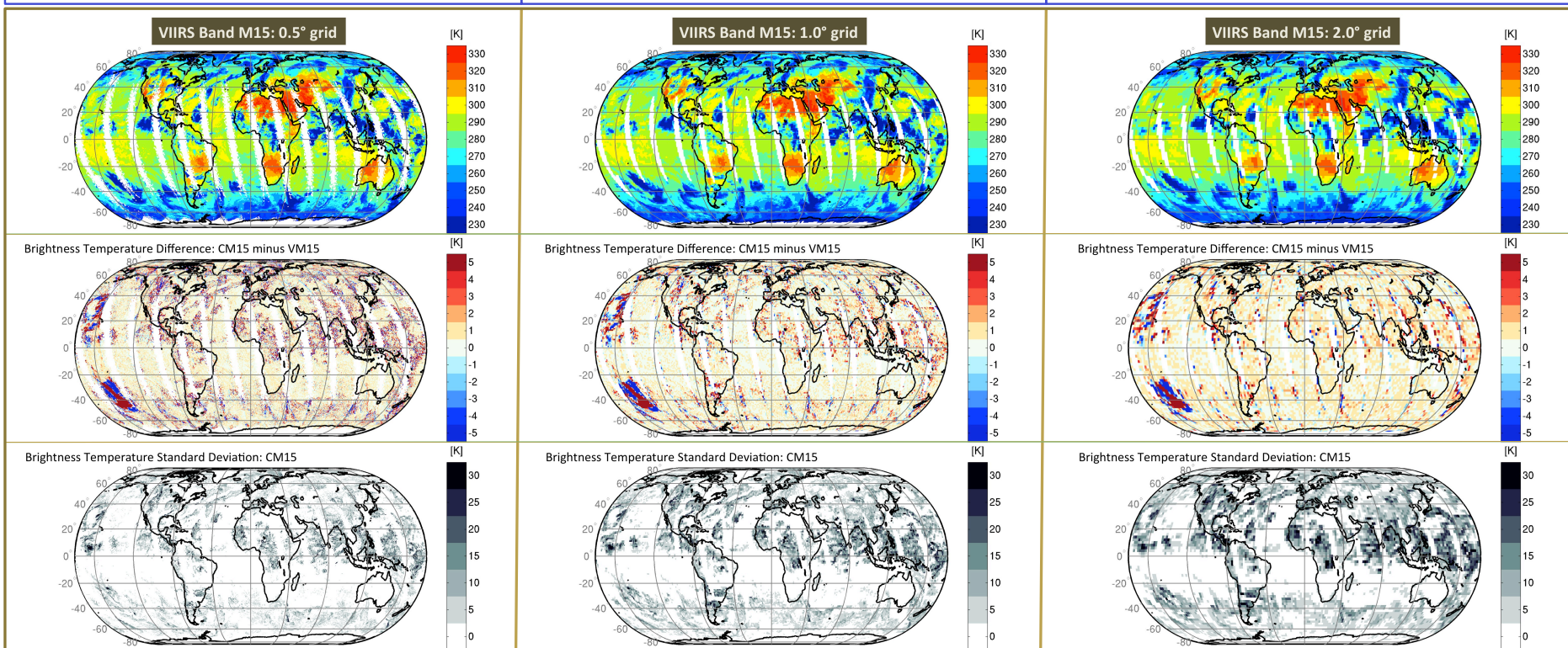
Uniformity test: CM15 grid cell standard deviation < threshold [K]. (Different types of uniformity tests exist and will be tested in future work)

Heterogeneity test: absolute value of difference (CM15 minus VM15) < threshold [K]

Table 1: Number of global grid cells as percentage of the total available grid cells (i.e. available sample size for calculation of daily statistics) where daily average brightness temperature between imager and sounder show strong agreement.

Heterogeneity threshold [K]	0.5° grid (ng ¹ = ~200k)	1.0° grid (ng = ~54k)	2.0° grid (ng = ~14k)
5	41%	64%	51%
2	40%	28%	16%
1	36%	27%	16%
0.5	24%	21%	12%
0.2	6%	5%	2%

¹ng = total number of global grid cells where both imager and sounder have daily average values



Conclusions: For multi-instrument global analysis, time/resource expensive co-location schemes may not be necessary if uniform scenes are selected correctly. Global statistics are insensitive to grid cell size as long as a significant sample size is maintained. Sub-pixel heterogeneity should be carefully considered.

The STG algorithm is described here:

- Smith, N, W.P. Menzel, E. Weisz, A. Heidinger and B.A. Baum. 2013. A uniform space-time gridding algorithm comparison of satellite data products: Characterization and sensitivity studies. *Journal of Applied Meteorology and Climatology*, 52: 255–268, doi: 10.1175/JAMC-D-12-031.1.
- CIMSS Science Symposium <http://www.youtube.com/user/UWSSEC/featured>